Instruction Manual

MLA-150
Fixed Angle Rotor

Used in the Beckman Coulter
Optima™ MAX-XP Ultracentrifuge

PN 393554AA
August 2007

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BECKMAN COULTER®

MLA-150 Rotor
PN 393554AA (August 2007)

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Safety Notice

This safety notice summarizes information basic to the safe use of the rotor described in this manual. The international symbol displayed above is a reminder that all safety instructions should be read and understood before operation or maintenance of this equipment is attempted. When you see the symbol on other pages throughout this publication, pay special attention to the safety information presented. Observance of safety precautions will also help to avoid actions that could damage or adversely affect the performance of the rotor. This rotor was developed, manufactured, and tested for safety and reliability as part of a Beckman Coulter ultracentrifuge/rotor system. Its safety or reliability cannot be assured if used in a centrifuge not of Beckman Coulter's manufacture or in a Beckman Coulter ultracentrifuge that has been modified without Beckman Coulter's approval.

Handle body fluids with care because they can transmit disease. No known test offers complete assurance that they are free of micro-organisms. Some of the most virulent—Hepatitis (B and C) viruses, HIV (I-V) viruses, atypical mycobacteria, and certain systemic fungi—further emphasize the need for aerosol protection. Handle other infectious samples according to good laboratory procedures and methods to prevent spread of disease. Because spills may generate aerosols, observe proper safety precautions for aerosol containment. Do not run toxic, pathogenic, or radioactive materials in this rotor without taking appropriate safety precautions. Biosafe containment should be used when Risk Group II materials (as identified in the World Health Organization *Laboratory Biosafety Manual*) are handled; materials of a higher group require more than one level of protection.

The rotor and accessories are not designed for use with materials capable of developing flammable or explosive vapors. Do not centrifuge such materials in nor handle or store them near the ultracentrifuge.

Although rotor components and accessories made by other manufacturers may fit in the MLA-150 rotor, their safety in this rotor cannot be ascertained by Beckman Coulter. Use of other manufacturers' components or accessories in the MLA-150 rotor may void the rotor warranty and should be prohibited by your laboratory safety officer. Only the components and accessories listed in this publication should be used in this rotor.

Make sure that filled containers are loaded symmetrically into the rotor and that opposing tubes are filled to the same level with liquid of the same density. Make sure that cavities in use have the proper spacers and/or floating spacers inserted before installing the rotor lid.

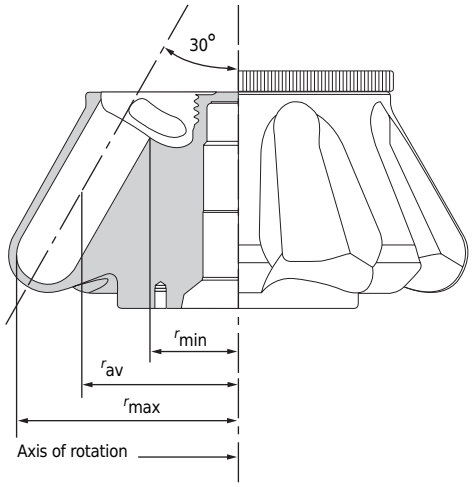
If disassembly reveals evidence of leakage, you should assume that some fluid escaped the rotor. Apply appropriate decontamination procedures to the centrifuge and accessories.

Never exceed the maximum rated speed of the rotor and labware in use. Refer to *Run Speeds*, and derate the run speed as appropriate.

Do not use sharp tools on the rotor that could cause scratches in the rotor surface. Corrosion begins in scratches and may open fissures in the rotor with continued use.

MLA-150 Rotor

Introduction



Specifications

Maximum speed: 150 000 RPM

Density rating at maximum speed: 1.7 g/mL

Relative Centrifugal Field* at maximum speed:
At r_{max} (39.9 mm): 1 003 000 x *g*
At r_{av} (27.8 mm): 700 200 x *g*
At r_{min} (15.8 mm): 397 400 x *g*

k factor at maximum speed: 10.4

Conditions requiring speed reductions: See *Run Speeds*

Number of tube cavities: 8

Available tubes: See Table 1

Nominal tube dimensions (largest volume tube, 344625): 11 x 32 mm

Nominal tube capacity (largest volume tube, 344625): 2 mL

Nominal rotor capacity: 16 mL

Approximate acceleration time to maximum speed (fully loaded): 3 min

Approximate deceleration time from maximum speed (fully loaded): 3 min

Weight of fully loaded rotor: 0.40 kg (0.89 lb)

Rotor material: titanium

Lid material: aluminum

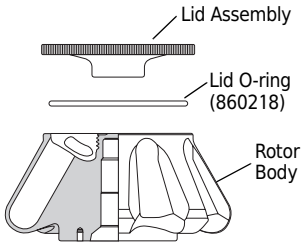
* Relative Centrifugal Field (RCF) is the ratio of the centrifugal acceleration at a specified radius and speed ($r\omega^2$) to the standard acceleration of gravity (g) according to the following formula:

$$RCF = \frac{r\omega^2}{g}$$

where r is the radius in millimeters, ω is the angular velocity in radians per second (2π RPM /60), and g is the standard acceleration of gravity (9807 mm/s^2). After substitution:

$$RCF = 1.12r\left(\frac{RPM}{1000}\right)^2$$

Description



This rotor has been manufactured in a registered ISO 9001 or 13485 facility for use with the appropriately classified Beckman Coulter ultracentrifuge.

The MLA-150 rotor, rated for 150 000 RPM, has a tube angle of 30 degrees from the axis of rotation. The rotor can centrifuge up to eight tubes and is used in the Beckman Coulter Optima™ MAX-XP ultracentrifuge.

The rotor is made of titanium and is finished with black polyurethane paint. The lid is made of aluminum and is anodized to resist corrosion. A rotor retention mechanism on the ultracentrifuge drive hub secures the rotor during the run. A lubricated O-ring in the lid maintains atmospheric pressure inside the rotor during centrifugation. The tube cavities are numbered to aid in sample identification.

The ultracentrifuge identifies rotor speed during the run by means of a magnetic speed sensor in the instrument chamber and magnets on the bottom of the rotor. This overspeed protection system ensures that the rotor does not exceed its maximum speed.

See the Warranty at the back of this manual for warranty information.

Preparation and Use

Specific information about the MLA-150 rotor is given here. Information common to this and other rotors is contained in Rotors and Tubes for Tabletop Preparative Ultracentrifuges *(publication TLR-IM), which should be used with this manual for complete rotor and accessory operation. Publication TLR-IM is included in the literature package shipped with the rotor. Other referenced publications are available at www.beckmancoulter.com.*

NOTE

Although rotor components and accessories made by other manufacturers may fit in the MLA-150 rotor, their safety in this rotor cannot be ascertained by Beckman Coulter. Use of other manufacturers' components or accessories in the MLA-150 rotor may void the rotor warranty and should be prohibited by your laboratory safety officer. Only the components and accessories listed in this publications should be used in this rotor.

Prerun Safety Checks

Read the Safety Notice page at the front of this manual before using the rotor.

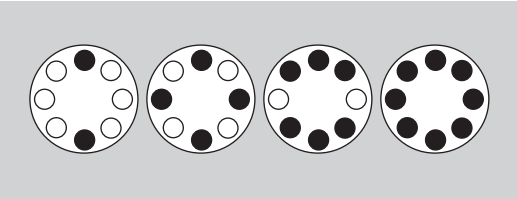
1. Inspect the O-ring and lid for damage—the high forces generated in this rotor can cause damaged components to fail.
2. Make sure you use only tubes and accessories listed in Table 1.
3. Check the chemical compatibilities of all materials used (refer to Appendix A in *Rotors and Tubes for Tabletop Preparative Ultracentrifuges*).

Rotor Preparation

For runs at other than room temperature, refrigerate or warm the rotor beforehand for fast equilibration.

1. Lightly but evenly lubricate metal threads with Spinkote™ lubricant (306812).
2. Apply a thin film of silicone vacuum grease (335148) to the O-ring in the rotor lid.
3. Load the filled and capped tubes symmetrically into the rotor (see Quick-Seal® Tubes). If fewer than eight tubes are being run, they must be arranged symmetrically in the rotor (see Figure 1, Arranging Tubes in the Rotor). *Opposing tubes must be filled to the same level with liquid of the same density.* Two, four, six, or eight tubes can be centrifuged per run if they are arranged in the rotor as shown in Figure 1.

Figure 1 Arranging Tubes in the Rotor



4. Use the required spacers, if necessary (see Table 1), to complete the loading operation.
5. After loading the rotor, place the lid onto the rotor threads. Advance the lid to the right (clockwise) by hand until the O-ring begins to contact the rotor body. Continue tightening the lid approximately an additional 1/8 of a revolution. No tool is required.

NOTE

The distance between tube cavities is 1/8 of a revolution. You can use the eight scallops in the rotor body as a visual guide.

Operation

1. Use an absorbent towel to wipe off condensation from the rotor.
2. Carefully place the rotor on the drive hub.
3. For information on ultracentrifuge operation, refer to the instrument instruction manual.
4. For additional operating information, see the following:
   - *Run Times* for using *k* factors to adjust run durations.
   - *Run Speeds* for information on speed limitations.
   - *Selecting CsCl Gradients* for methods to avoid CsCl precipitation during centrifugation.

Removal and Sample Recovery

CAUTION

If disassembly reveals evidence of leakage, you should assume that some fluid escaped from the rotor. Apply appropriate decontamination procedures to the centrifuge and accessories.

1. Remove the rotor from the ultracentrifuge, and place it on a flat surface.
2. Remove the lid by unscrewing it to the left (counterclockwise).
3. Use a tube removal tool to remove the spacers and tubes.

Tubes and Accessories

The MLA-150 rotor uses tubes and accessories listed in Table 1. Be sure to use only those items listed, and to observe the maximum fill volumes and speed limits shown. Refer to Appendix A in *Rotors and Tubes for Tabletop Preparative Ultracentrifuges* for information on the chemical resistances of tube and accessory materials.

Temperature Limits

- Plastic tubes have been centrifuge tested for use at temperatures between 2 and 25°C. For centrifugation at other temperatures, pretest tubes under anticipated run conditions.
- If plastic containers are frozen before use, make sure that they are thawed to at least 2°C prior to centrifugation.

Table 1 Available Tubes for the MLA-150 Rotor

Tube			Required Accessory		Max Speed/ RCF/ *k* Factor[a]
Dimensions/ Volume	**Description**	**Part Number**	**Description**	**Part Number**	
11 x 32 mm 2.0 ml	Quick-Seal polyallomer, bell top	344625 (pkg/50)	Floating Spacer, Ultem[b]	393570 (pkg/8)	150 000 RPM 989 000 x *g* 8.0
11 x 25 mm 1.5 ml	Quick-Seal polyallomer, bell top	344624 (pkg/50)	Floating Spacer, Ultem	393570 (pkg/8)	150 000 RPM 989 000 x *g* 6.2
11 x 34 mm 1.0 ml	Thickwall polycarbonate	343778 (pkg/100)	none	—	150 000 RPM 964 000 x *g* 4.6
11 x 34 mm 1.0 ml	Thickwall polyallomer	347287 (pkg/100)	none	—	95 000 RPM 387 000 x *g* 11.4

a. The RCF and *k* Factor calculations use r_{max} values that are reduced by the tube wall thickness.

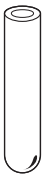
b. Ultem is a registered trademark of GE Plastics.

Quick-Seal® Tubes

Quick-Seal tubes must be sealed prior to centrifugation. These tubes are heat sealed and do not need caps; however, spacers are required on top of the tubes when they are loaded into the rotor.

- Fill Quick-Seal tubes leaving a *small* bubble of air at the base of the neck. Do not leave a large air space—too much air can cause excessive tube deformation.
- Refer to *Rotors and Tubes for Tabletop Preparative Ultracentrifuges* for detailed information on the use and care of Quick-Seal tubes.

Thickwall Tubes



Thickwall polyallomer and polycarbonate tubes can be run partially filled (maximum of 1 ml) without caps. All opposing tubes installed in a rotor must be filled with a like substance to maintain balance during centrifugation. To avoid spillage, do not overfill capless tubes. Be sure to note reductions in centrifugation speed shown in Table 1.

Run Times

The *k* factor of the rotor is a measure of the rotor's pelleting efficiency. (Beckman Coulter has calculated the *k* factors for all of its preparative rotors at maximum rated speed using tubes filled to their maximum recommended levels.) The *k* factor is calculated from the formula:

$$k = \frac{1n(r_{max}/r_{min})}{\omega^2} \times \frac{10^{13}}{3600} \quad (1)$$

where ω is the angular velocity of the rotor in radians per second (ω=0.105 x RPM), r_{max} is the maximum radius, and r_{min} is the minimum radius.

After substitution:

$$k = \frac{(2.533 \times 10^{11})1n(r_{max}/r_{min})}{RPM^2} \quad (2)$$

Use the *k* factor in the following equation to estimate the run time *t* (in hours) required to pellet particles of known sedimentation coefficient *s* (in Svedberg units, *S*):

$$t = \frac{k}{S} \tag{3}$$

Run times can be estimated for centrifugation at less than maximum speed by adjusting the *k* factor as follows:

$$k_{adj} = k \left(\frac{150\,000}{\text{actual run speed}} \right)^2 \tag{4}$$

Run times can also be estimated from data established in prior experiments if the *k* factor of the previous rotor is known. For any two rotors, a and b:

$$\frac{t_a}{t_b} = \frac{k_a}{k_b} \tag{5}$$

For more information on *k* factors, see *Use of k Factor for Estimating Run Times from Previously Established Run Conditions* (publication DS-719).

Run Speeds

The centrifugal force at a given radius in a rotor is a function of speed. You can compare forces between different rotors by comparing the rotors' relative centrifugal fields (RCF). Identical samples in different rotors are subjected to the same force if the speed of the rotors is adjusted to produce the same RCF. The RCF for the cell hole and various labware is provided in Table 2.

You must reduce speeds under the following circumstances:

- If you centrifuge non-precipitating solutions having a density greater than 1.7 g/mL, reduce the maximum allowable run speed according to the following equation:

$$\text{reduced maximum speed} = (150\,000 \text{ RPM}) \sqrt{\frac{1.7 \text{ g/mL}}{\rho}} \tag{6}$$

  where ρ is the density (g/mL) of the tube contents. This speed reduction will protect the rotor from excessive stresses due to the added tube load. *Note, however, that the use of this formula may still produce maximum speed values that are higher than the limitations imposed by the use of certain tubes or adapters.* In such cases, use the lower of the two values.
- *You must impose further speed limits* when CsCl or other self-forming-gradient salts are centrifuged, as equation (6) does not predict concentration limits/speeds that are required to avoid precipitation of salt crystals. Precipitation during centrifugation would alter the density distribution of CsCl and this would change the position of the sample bands. The illustrations and examples in *Selecting CsCl Gradients* show how to reduce run speeds when using CsCl gradients.

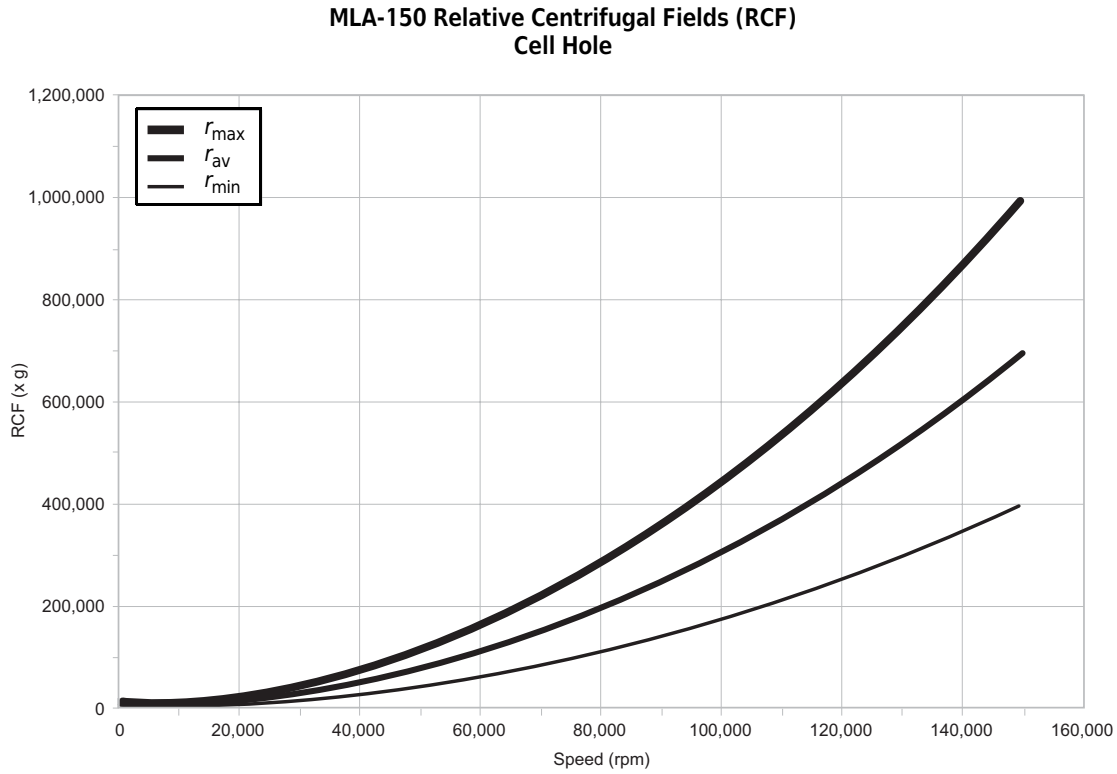
Table 2 Relative Centrifugal Fields for Cell Holes of the MLA-150 Rotor

Rotor Speed (RPM)	Relative Centrifugal Field (x *g*)[a]			*k* Factor[b]
	At r_{max} (39.9 mm)	At r_{av} (27.8 mm)	At r_{min} (15.8 mm)	
150 000	1 003 000	700 000	397 000	10.4
145 000	937 000	654 000	371 000	11
140 000	874 000	610 000	346 000	12
135 000	812 000	567 000	322 000	13
130 000	753 000	526 000	298 000	14
125 000	697 000	486 000	276 000	15
120 000	642 000	448 000	254 000	16
115 000	590 000	412 000	234 000	18
110 000	539 000	377 000	214 000	19
105 000	491 000	343 000	195 000	21
100 000	446 000	311 000	177 000	23
95 000	402 000	281 000	159 000	26
90 000	361 000	252 000	143 000	29
85 000	322 000	225 000	128 000	32
80 000	285 000	199 000	113 000	37
75 000	251 000	175 000	99 300	42
70 000	218 000	152 000	86 500	48
65 000	188 000	131 000	74 600	56
60 000	160 000	112 000	63 600	65
55 000	135 000	94 100	53 400	78
50 000	111 000	77 800	44 200	94
45 000	90 300	63 000	35 800	116
40 000	71 300	49 800	28 300	147
35 000	54 600	38 100	21 600	191
30 000	40 100	28 000	15 900	261
25 000	27 900	19 400	11 000	375
20 000	17 800	12 400	7 060	586
15 000	10 000	7 000	3 970	1 042
10 000	4 460	3 110	1 770	2 345
5 000	1 110	778	442	9 380

a. Entries in this table are calculated from the formula RCF = 1.12r (RPM/1000)^2. The “r” values are rounded to three significant digits.

b. Calculated for all Beckman Coulter preparative rotors as a measure of the rotor’s relative efficiency in pelleting sample in water at 20°C.

Figure 2 Relative Centrifugal Fields (RCF) for the MLA-150 Rotor



Selecting CsCl Gradients

Precipitation during centrifugation would alter density distribution, and this would change the position of the sample bands. Curves in Figure 3 and Figure 4 are provided up to the maximum rated speed of the rotor.

NOTE

The curves in Figure 3 and Figure 4 are for solutions of CsCl salt dissolved in distilled water only. If other salts are present in significant concentrations, the overall CsCl concentration may need to be reduced.

Rotor speed is used to control the slope of a CsCl density gradient and must be limited to avoid CsCl precipitation. Speed and density combinations that intersect on or below the curves in Figure 3

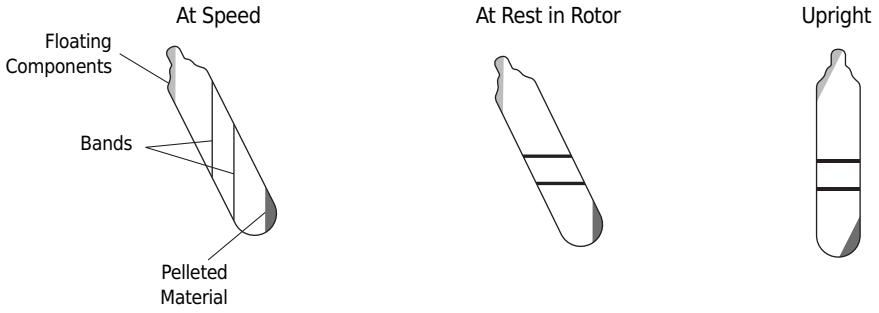
ensure that CsCl will not precipitate during centrifugation in the MLA-150 rotor. Curves are provided at two temperatures: 20°C (black curves) and 4°C (gray curves).

The reference curves in Figure 4 show gradient distribution at equilibrium. Each curve in Figure 4 is within the density limits allowed for the MLA-150 rotor: each curve was generated for a single run speed using the maximum allowable homogeneous CsCl densities (one for each fill level) that avoid precipitation at that speed. (The gradients in Figure 4 can be generated from step or linear gradients, or from homogeneous solutions. However, the total amount of CsCl in solution must be equivalent to a homogeneous solution corresponding to the concentrations specified in Figure 3.) Figure 4 can also be used to approximate the banding positions of sample particles.

Typical Examples for Determining CsCl Run Parameters

Example A

A separation that is done frequently is the banding of plasmid DNA in cesium chloride with ethidium bromide. The starting density of the CsCl solution is 1.55 g/mL. In this separation, the covalently closed, circular plasmid bands at a density of 1.57 g/mL, while the nicked and linear species band at 1.53 g/mL. At 20°C, where will particles band?



1. In Figure 3, find the curve that corresponds to the desired run temperature (20°C) and fill volume (in this case, full). The maximum allowable rotor speed (97 300) RPM is determined from the point where this curve intersects a line drawn at the homogeneous CsCI density (1.55 g/mL).
2. In Figure 4, sketch in a horizontal line corresponding to each particle's buoyant density.
3. Mark the point in the figure where each particle density intersects the curve corresponding to the selected run speed (90 000 RPM) and temperature (20°C).
4. Particles will band at these locations across the tube diameter at equilibrium during centrifugation.

In this example, particles will band about 28.0 and 26.1 mm from the axis of rotation, about 1.9 mm of centerband-to-centerband separation at the rotor's 30-degree tube angle. When you hold the tube upright, there will be about 2.2 mm of centerband-to-centerband separation. You can calculate this interband distance, d_{up}, from the formula:

$$d_{up} = \frac{d_{\theta}}{\cos\theta} \tag{7}$$

where d_θ is the interband distance when the tube is held at an angle, θ, in the rotor.

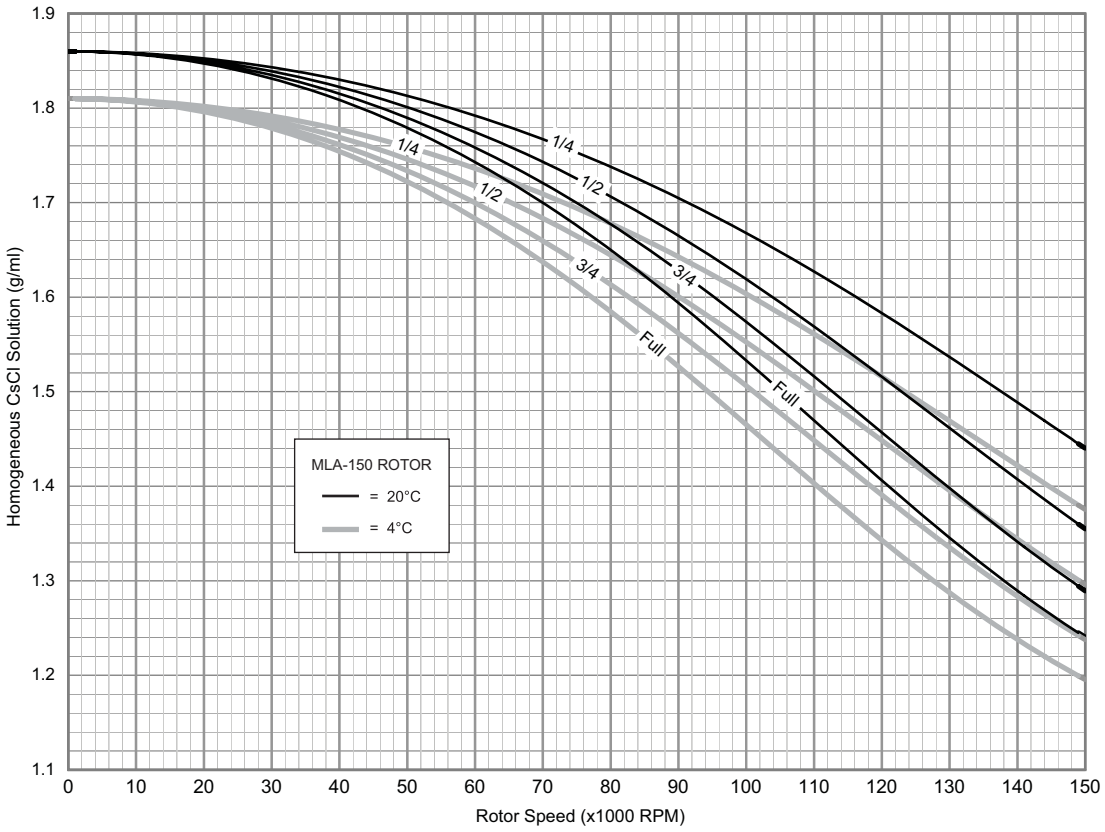
Example B

Knowing particle buoyant densities (e.g., 1.59 and 1.54 g/mL), how do you achieve good separation?

1. In Figure 4, sketch in a horizontal line corresponding to each particle's buoyant density.
2. Select the 70 000 RPM curve at the desired temperature (4°C) to give the best particle separation, that is, a shallow gradient with the material positioned near the middle of the tube.
3. With a run speed of 70 000 RPM and a selected fill volume (full), determine the maximum homogeneous CsCI density from Figure 3.
4. From Figure 3, the maximum homogeneous CsCl density (1.637 g/mL) is found by locating the point on the "Full" curve for 4°C where it crosses 70 000 RPM. Using a homogenous CsCI density of 1.55 g/mL will provide the particle-banding pattern selected in Step 2.

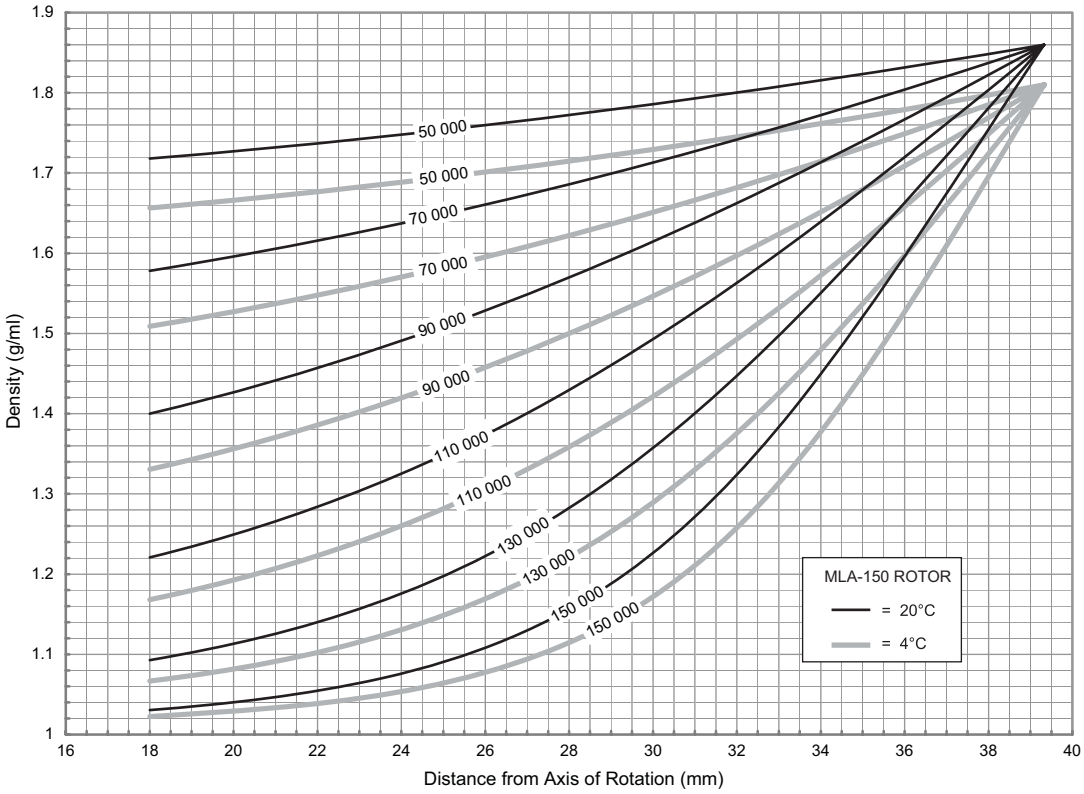
In this example, particles will band at about 25.6 and 21.3 mm from the axis of rotation (about 2.3 mm apart). When you hold the tube upright, there will be about 2.7 mm of center-of-band to center-of-band separation.

Figure 3 CsCI Precipitation Curves for the MLA-150 Rotor



Using combinations of rotor speeds and homogeneous CsCl solution densities that intersect on or below these curves ensures that CsCl will not precipitate during centrifugation.

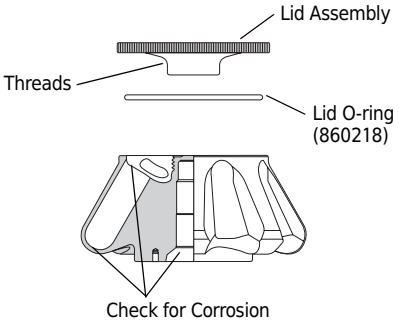
Figure 4 CsCl Gradients at Equilibrium for the MLA-150 Rotor with Quick-Seal® Tube (344625)



Centrifugation of homogeneous CsCl solutions at the maximum allowable speeds (from Figure 3) results in gradients presented in Figure 4.

Care and Maintenance

Maintenance



NOTE

Do not use sharp tools on the rotor that could cause scratches in the rotor surface. Corrosion begins in scratches and may open fissures in the rotor with continued use.

- Regularly lubricate the metal threads in the rotor with a thin, even coat of Spinkote lubricant. Failure to keep these threads lubricated can result in damaged threads.
- Regularly apply silicone vacuum grease to the lid O-ring. Replace the O-ring about twice a year or whenever worn or damaged.

NOTE

This lid O-ring (860218) is specifically designed for use with the MLA-150 rotor and is not interchangeable with other O-rings. Do not substitute any other O-ring for use in this rotor.

- Check lid center threads for evidence of distortion, overtightening, or damage.

Refer to Appendix A in *Rotors and Tubes for Tabletop Preparative Ultracentrifuges* for the chemical resistances of rotor and accessory materials. Your Beckman Coulter representative is your point of contact for the Field Rotor Inspection Program and the rotor repair center.

Cleaning

Wash the rotor and rotor components immediately if salts or other corrosive materials are used or if spillage has occurred. Do not allow corrosive materials to dry on the rotor.

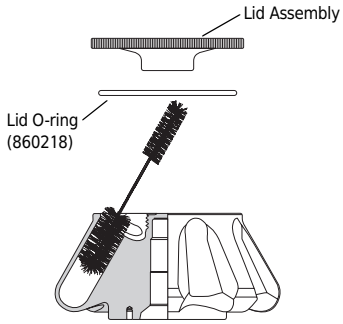
Under normal use, clean the rotor frequently (at least weekly) to prevent buildup of residues.

NOTE

Do not wash rotor components in a dishwasher. Do not soak in detergent solution for long periods, such as overnight.

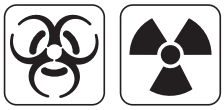
1. Remove the lid O-ring before washing.
2. Wash the rotor and lid in a mild detergent, such as Beckman Solution 555™ (339555), that won't damage the rotor. The Rotor Cleaning Kit contains two plastic-coated brushes and two quarts of Solution 555 for use with rotors and accessories. Dilute the detergent 10 to 1 with water.
3. Rinse the cleaned rotor and components with distilled water.
4. Air-dry the rotor and lid upside down. *Do not use acetone to dry the rotor.* Ensure that magnet locations on the rotor bottom are thoroughly dry to prevent corrosion
5. Apply a thin, even coat of silicone vacuum grease to the lid O-ring before replacing it in the groove in the lid.

Clean metal threads as necessary (at least every 6 months). Use a brush and concentrated Solution 555. Rinse and dry thoroughly, then lubricate lightly but evenly with Spinkote to coat all threads.



Periodically remove the lid O-ring and wipe clean as necessary. Clean the O-ring groove with a cotton-tipped swab. Reapply a light film of silicone vacuum grease.

Decontamination



If the rotor or other components are contaminated with radioactive, toxic, or pathogenic materials, follow appropriate decontamination procedures as outlined by appropriate laboratory safety guidelines and/or other regulations. Consult Appendix A in *Rotors and Tubes for Tabletop Preparative Ultracentrifuges* to select an agent that will not damage the rotor.

Sterilization and Disinfection

- The rotor and all rotor components can be autoclaved at 121°C for up to an hour. Remove the lid and O-ring from the rotor and place the rotor and lid in the autoclave upside down.
- Ethanol (70%)* or hydrogen peroxide (6%) may be used on all rotor components, including those made of plastic. Bleach (sodium hypochlorite) may be used, but may cause discoloration of anodized surfaces. Use the minimum immersion time for each solution, per laboratory standards.

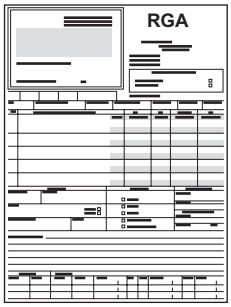
While Beckman Coulter has tested these methods and found that they do not damage the rotor components, no guarantee of sterility or disinfection is expressed or implied. When sterilization or disinfection is a concern, consult your laboratory safety officer regarding proper methods to use.

Storage

When it is not in use, store the rotor in a dry environment (not in the instrument) with the lid removed to allow air circulation so moisture will not collect in the tube cavities.

* Flammability hazard. Do not use in or near operating ultracentrifuges.

Returning a Rotor



Before returning a rotor or accessory for any reason, prior permission (a Returned Goods Authorization form) must be obtained from Beckman Coulter, Inc. This RGA form may be obtained from your local Beckman Coulter sales office, and should contain the following information:

- Serial number
- History of use (approximate frequency of use)
- Reason for the return
- Original purchase order number, billing number, and shipping number, if possible
- Name and phone number of the person to be notified upon receipt of the rotor or accessory at the factory
- Name and phone number of the person to be notified about repair costs, etc.

To protect our personnel, it is the customer's responsibility to ensure that all parts are free from pathogen's and/or radioactivity. Sterilization and decontamination must be done before returning the parts. Smaller items (such as tubes, bottles, etc.) should be enclosed in a sealed plastic bag.

All parts must be accompanied by a note, plainly visible on the outside of the box or bag, stating that they are safe to handle and that they are not contaminated with pathogens or radioactivity. ***Failure to attach this notification will result in return or disposal of the items without review of the reported problem.***

Use the address label printed on the RGA form when mailing the rotor and/or accessories to:

Beckman Coulter
1050 Page Mill Road
Palo Alto, CA 94304
Attention: Returned Goods

Customers located outside the United States should contact their local Beckman Coulter office.

Supply List

See the Beckman Coulter *Ultracentrifuge Rotors, Tubes & Accessories* catalog (BR-8101) or contact Beckman Coulter Sales (1-800-742-2345 in the United States; worldwide offices are listed on the back cover of this manual) for detailed information on ordering parts and supplies. For your convenience, a partial list is given below. Publications referenced in this manual can be obtained by calling 1-800-742-2345 in the United States, or by contacting your local Beckman Coulter office.

Replacement Rotor Parts

MLA-150 rotor assembly	393489
Lid O-ring	860218

Other

Tubes and accessories:	
Open Top Tube (1.0 ml, Polycarbonate), Package of 100	343778
Open Top Tube (1.0 ml, Polyallomer), Package of 100	347287
Quick Seal Tube (1.5 ml, Polyallomer), Package of 50	344624
Quick Seal Tube (2.0 ml, Polyallomer), Package of 50	344625
Spacer for Quick Seal Tube, Package of 8	393570
Quick-Seal Cordless Tube Topper kit, 60 Hz	358312
Quick-Seal Cordless Tube Topper kit, 60 Hz (Canada)	367803
Quick-Seal Cordless Tube Topper kit, 50 Hz (Europe)	358313
Quick-Seal Cordless Tube Topper kit, 50 Hz (Great Britain)	358314
Quick-Seal Cordless Tube Topper kit, 50 Hz (Australia)	358315
Tube Topper rack	349387
Tube removal tool	361668
Curved hemostat (6-in.)	927208
Straight hemostat (6-in.)	961519
Fraction Recovery System	342025
Fraction Recovery System Adapter Kit for TL-series tubes	347828
Spinkote lubricant (2 oz)	306812
Silicone vacuum grease (1 oz)	335148
Rotor Cleaning Kit	339558
Rotor cleaning brush	347404
Beckman Solution 555 (1 qt)	339555

Ultracentrifuge Rotor Warranty

All Beckman Coulter ultracentrifuge Fixed Angle, Vertical Tube, Near Vertical Tube, Swinging Bucket, and Airfuge rotors are warranted against defects in materials or workmanship for the time periods indicated below, subject to the Warranty Conditions stated below.

Preparative Ultracentrifuge Rotors	5 years, No Proration
Analytical Ultracentrifuge Rotors	5 years, No Proration
ML and TL Series Ultracentrifuge Rotors	5 years, No Proration
Airfuge Ultracentrifuge Rotors	1 year, No Proration

For Zonal, Continuous Flow, Component Test, and Rock Core ultracentrifuge rotors, see separate warranty.

Warranty Conditions (as applicable)

1. This warranty is valid for the time periods indicated above from the date of shipment to the original Buyer by Beckman Coulter or an authorized Beckman Coulter representative.
2. This warranty extends only to the original Buyer and may not be assigned or extended to a third person without written consent of Beckman Coulter.
3. This warranty covers the Beckman Coulter Centrifuge Systems only (including but not limited to the centrifuge, rotor, and accessories) and Beckman Coulter shall not be liable for damage to or loss of the user's sample, non-Beckman Coulter tubes, adapters, or other rotor contents.
4. This warranty is void if the Beckman Coulter Centrifuge System is determined by Beckman Coulter to have been operated or maintained in a manner contrary to the instructions in the operator's manual(s) for the Beckman Coulter Centrifuge System components in use. This includes, but is not limited to operator misuse, abuse, or negligence regarding indicated maintenance procedures; centrifuge and rotor classification requirements; proper speed reduction for the high density of certain fluids, tubes, and tube caps; speed reduction for precipitating gradient materials; and speed reduction for high-temperature operation.
5. Rotor bucket sets purchased concurrently with or subsequent to the purchase of a Swinging Bucket Rotor are warranted only for a term co-extensive with that of the rotor for which the bucket sets are purchased.
6. This warranty does not cover the failure of a Beckman Coulter rotor in a centrifuge not of Beckman Coulter manufacture, or if the rotor is used in a Beckman Coulter centrifuge that has been modified without the written permission of Beckman Coulter, or, if the rotor is used with carriers, buckets, belts, or other devices not of Beckman Coulter manufacture.
7. Rotor parts subject to wear, including, but not limited to, rotor O-rings, VTi, NVT™, TLV, MLN, and TLN rotor tube cavity plugs and gaskets, tubing, tools, optical overspeed disks, bearings, seals, and lubrication are excluded from this warranty and should be frequently inspected and replaced if they become worn or damaged.
8. Keeping a rotor log is not mandatory, but may be desirable for maintenance of good laboratory practices.

Repair and Replacement Policies

1. If a Beckman Coulter rotor is determined by Beckman Coulter to be defective, Beckman Coulter will repair or replace it, subject to the Warranty Conditions. A replacement rotor will be warranted for the time remaining on the original rotor's warranty.
2. If a Beckman Coulter centrifuge is damaged due to a failure of a rotor covered by this warranty, Beckman Coulter will supply free of charge (i) all centrifuge parts required for repair (except the drive unit, which will be replaced at the then current price less a credit determined by the total number of revolutions or years completed, provided that such a unit was manufactured or rebuilt by Beckman Coulter), and (ii) if the centrifuge is currently covered by a Beckman Coulter warranty or Full Service Agreement, all labor necessary for repair of the centrifuge.
3. If a Beckman Coulter rotor covered by this warranty is damaged due to a malfunction of a Beckman Coulter ultracentrifuge covered by an Ultracentrifuge System Service Agreement, Beckman Coulter will repair or replace the rotor free of charge.

4. If a Beckman Coulter rotor covered by this warranty is damaged due to a failure of a Beckman Coulter tube, bottle, tube cap, spacer, or adapter, covered under the Conditions of this Warranty, Beckman Coulter will repair or replace the rotor and repair the instrument as per the conditions in policy point (2) above, and the replacement policy.

5. Damage to a Beckman Coulter rotor or instrument due to the failure or malfunction of a non-Beckman Coulter tube, bottle, tube cap, spacer, or adapter is not covered under this warranty, although Beckman Coulter will assist in seeking compensation under the manufacturer's warranty.

Disclaimer

IT IS EXPRESSLY AGREED THAT THE ABOVE WARRANTY SHALL BE IN LIEU OF ALL WARRANTIES OF FITNESS AND OF THE WARRANTY OF MERCHANTABILITY AND BECKMAN COULTER, INC. SHALL HAVE NO LIABILITY FOR SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY KIND WHATSOEVER ARISING OUT OF THE MANUFACTURE, USE, SALE, HANDLING, REPAIR, MAINTENANCE, OR REPLACEMENT OF THE PRODUCT.

Factory Rotor Inspection Service

Beckman Coulter, Inc., will provide free mechanical and metallurgical inspection in Palo Alto, California, USA, of any Beckman Coulter rotor at the request of the user. (Shipping charges to Beckman Coulter are the responsibility of the user.) Rotors will be inspected in the user's laboratory if the centrifuge in which they are used is covered by an appropriate Beckman Coulter Service Agreement. Contact your local Beckman Coulter office for details of service coverage or cost.

Before shipping, contact the nearest Beckman Coulter Sales and Service office and request a Returned Goods Authorization (RGA) form and packaging instructions. Please include the complete rotor assembly, with buckets, lid, handle, tube cavity caps, etc. A SIGNED STATEMENT THAT THE ROTOR AND ACCESSORIES ARE NON-RADIOACTIVE, NON-PATHOGENIC, NON-TOXIC, AND OTHERWISE SAFE TO SHIP AND HANDLE IS REQUIRED.

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